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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/547,034 | 04/11/2000 | Michael Ben Nun | Q58178 | 4164 |

7590 07/27/2004

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| ART UNIT | PAPER NUMBER |
|---|---|
| 2188 | |

DATE MAILED: 07/27/2004

11

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/547,034 | NUN ET AL. | |
| | Examiner | Art Unit | |
| | John M Ross | 2188 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *07 July 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-63* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-63* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7 July 2004 has been entered.

### *Status of Claims*

2. Claims 1, 16, 31-33, 39-41 and 47 are amended.

Claims 1-63 are pending in the application.

Claims 1-63 are rejected.

### *Response to Amendment*

3. Applicant's amendments and arguments filed on 7 July 2004 (Paper No. 10) in response to the office action mailed on 9 February 2004 have been fully considered, but they are not persuasive. Therefore, the rejections made in the previous office action are maintained, and restated below, with changes as necessitated by the amendments.

***Drawings***

4. Figures 1 and 4 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Figs. 1 and 4 are discussed in relationship to admitted prior art (APA) in the background of the invention (see Page 1, lines 25-26 and page 2, line 25).

Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Objections***

5. Claims 1-30 and 47-61 are objected to because of the following informalities:

The phrase "M at least smaller" (Claim 1, line 4; claim 16, lines 6-7; claim 47, lines 5-6) should be "M is at least smaller". The claims will be interpreted in light of this suggestion.

Claim 27 appears to have been inadvertently renumbered as claim 26. The claim number should be changed back to 27. The claims will be interpreted accordingly.

All dependent claims are objected to as having the same deficiencies as the claims they depend from.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 1-63 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 1 recites an "N-bit input ... wherein N is larger than or equal to 84" (Claim 1, lines 1-2), and an "M-bit hash address ... M is at least smaller than 32" (Claim 1, lines 4-5), however, these values for N and M are not supported by the specification. While the specification teaches that "M is significantly smaller than N" (Page 11, lines 6-7), the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

It appears that the claim seeks to define the term "significantly smaller" by specifying "N is larger than or equal to 84" and "M is a least smaller than 32". However, in order to be enabled these limitations must be found in the specification, otherwise they constitute new matter.

The specification states that N is preferably greater than 96 (Page 12, line 8). The value of 84 only appears in the context of a subset of the total N bits to be used for a hashing and is not taught as a value for N (Page 21, lines 4-7). Therefore, the specification provides no support for a value of N less than or equal to 96.

The specification also states that M is preferably equal to 20 (Page 13, line 15). The value of 32 only appears in the specification in relation to the size of a comparator used to compare a tuple to memory contents (Page 21, lines 7-11). Therefore, the specification provides no support for a value of M greater than 20.

It is suggested that the phrase "N is larger than or equal to 84" in line 2 of claim 1 be replaced by the phrase "N is larger than 96". It is further suggested that the phrase "M is at least smaller than 32" in lines 4-5 of claim 1 be replaced by the phrase "M is at least equal to or smaller than 20".

The claims will be interpreted in light of these suggestions.

Claims 16, 31, 39 and 47 contain similar deficiencies as claim 1 and are therefore rejected using the same rationale as for the rejection of claim 1 above. The suggestions made regarding claim 1 are also applied to claims 16, 31, 39 and 47. The claims will be interpreted in light of these suggestions.

It is noted that claims 13, 28 and 59 recite the limitation "N > 96". In view of the above suggestions, claims 13, 28 and 59 should also be canceled as they do not further limit the parent claims. The claims will be interpreted in light of this suggestion.

Claim 31 recites "X is equal to or smaller than M" (Claim 31, line 4). There is no basis for this limitation in the specification. For the purposes of examination this limitation will be ignored.

Claim 32 recites "X is at least two thirds of N" (Claim 32, line 2). By similar reasoning as in the rejection of claim 1 under the second paragraph of 35 U.S.C. 112, unless this limitation is supported by the specification it would appear to be new matter. The specification teaches that N is greater than 96 (Page 12, line 8), and gives a specific example where N is 104 (Page 13, line 13). The specification also teaches that X is equal to 96 (Page 13, line 14) and may be as small as 84 (Page 21, lines 4-7). However, a specific ratio of X to N is not taught in the specification, and for the values of X and N given in the specification there is no teaching that would lead to a conclusion that X is at least two thirds of N. Therefore, this limitation appears to be new matter and will be ignored accordingly.

Claim 33 recites "Z is smaller than 32". By similar reasoning as in the rejection of claim 1 under the second paragraph of 35 U.S.C. 112, unless this limitation is supported by the specification it would appear to be new matter. The specification teaches that Z is equal to 20

(Page 13, line 15) and gives no other indication as to its absolute or relative size. Therefore, this limitation appears to be new matter and will be ignored accordingly.

Claims 40 and 41 contain similar deficiencies as claims 32 and 33 and are therefore rejected using the same rationale as for the rejection of claims 32 and 33 above, and will be treated in the same manner.

All dependent claims are rejected under the same rationale as the claims they depend from.

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 32-33 and 40-41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. The term "significantly larger" in claims 32-33 and 40-41 is a relative term which renders the claims indefinite. The term "significantly larger" is not defined by the claims, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Regarding claims 32 and 40, although X may be understood to be larger than Y, neither the absolute nor relative magnitude of their difference can be ascertained. Furthermore, attempting to define the term "significantly larger" by defining X relative to N is ineffective because the term regards the value of X relative to Y.

Regarding claims 33 and 41, although X may be understood to be larger than Z, neither the absolute nor relative magnitude of their difference can be ascertained. Furthermore, attempting to define the term "significantly larger" by defining Z alone is ineffective because the term regards the value of X relative to Z.

For the purposes of examination, the term "significantly" will be ignored.

### *Claim Rejections - 35 USC § 103*

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1, 16 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214).

As in claims 1, 16 and 47, APA describes a commonly used system for the storing and look-up of internet protocol network tuples that comprises a hash address generator for mapping a plurality of tuples to a smaller plurality of hash addresses (Page 5, line 20 to page 6, line 6).

As in claims 1, 16 and 47, APA describes this system further comprising a memory for storing the tuples, where the memory is addressed by the hash addresses and each hash address corresponds to a bucket that contains a plurality of memory entries called slots, where each slot holds one tuple (Page 5, line 24 to page 6, line 2).

As in claims 1, 16 and 47, APA teaches that an N-bit tuple includes information about a source address, a destination address, protocol, a source and destination port (Page 3, lines 1-3).

APA does not teach that N is greater than 96 and M is equal to or smaller than 20 as required by claims 1, 16 and 47.

APA also does not teach a comparison unit to match incoming tuples to stored tuples, wherein an associated process flow information is output if a match is found, and wherein a new entry is created in the hash table for the incoming tuple if a match is not found, as required by claims 1, 16 and 47.

Lakshman teaches a traditional flow-cache architecture for packet classification in which incoming headers (i.e. tuples) are analyzed and when the header identifies a new flow, the header together with an associated action that must be applied to all packets in the flow (i.e. process flow information) are inserted in a hash table (Page 204, section 2.1, paragraph 1).

Lakshman further teaches that when subsequent packets in the flow arrive, the corresponding action is determined from the hash table (Page 204, section 2.1, paragraph 1). It is apparent in the teachings of Lakshman that determination of a new flow or the corresponding action for an existing flow requires a comparison unit to match incoming tuples with stored tuples, and that such a determination necessarily requires that the stored action (i.e. process flow information) be output if a match is found.

Lakshman also teaches that packet classification by parsing packet headers is a key mechanism for providing differentiated services to Internet users with widely varying requirements (Page 203, Abstract, paragraph 1).

Lakshman still further teaches that the input tuple size is between 100 and 200 (i.e. N is larger than 96) and that the hash index is no more than 20 (i.e. M is equal to or smaller than 20), in order to parse a typical packet header to match the limit in size for a hash table (Page 205, column 1, lines 13-19).

Regarding claims 1, 16 and 47, it would have been obvious to one of ordinary skill in the art at the time of invention by applicant to store tuples and their associated process flow information in a hash table, compare incoming tuples to stored tuples, output associated process flow information if a match is found, and create a new entry in the hash table if a match is not found as taught by Lakshman, in the system described by APA in order to provide the key mechanism for providing differentiated services to Internet users as taught by Lakshman.

Further regarding claims 1, 16 and 47, it would have been obvious to make N larger than 96 and M equal to or smaller than 20 in order to parse a typical packet header to match the limit in size for a hash table as also taught by Lakshman.

13. Claims 2, 12, 14-15, 17, 27, 29-30, 48, 58 and 60-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214) as applied to claims 1, 16 and 47 above, and further in view of Spinney (US 5,414,704).

APA and Lakshman are relied upon for the teachings relative to claims 1, 16 and 47 as above.

APA further teaches that according to theory the best way of making sure that packets reach their desired destination is to use a full 104-bit tuple, which enables a precise description

of the source and destination nodes, the input and output ports as well as the protocol used (Page 5, lines 8-13).

APA and Lakshman do not teach the use of a content addressable memory (CAM) to store overflowing tuples and their corresponding flow information when the tuple cannot be stored in memory as required by claims 2, 17 and 48.

APA and Lakshman also do not teach that the memory and CAM are searched in parallel as required by claims 12, 27 and 58.

Spinney teaches a system for address lookup used in data packet communications where source and destination addresses are stored as entries in a hash table, where that hash table is organized as a plurality of buckets, and each bucket has a plurality of slots for storing the entries (Fig. 1A, element 21; Fig. 8; column 3, lines 3-10; column 15, lines 19-36). Spinney further teaches that when the network is initialized or reconfigured, there is a non-zero probability that the slots of a hash bucket will become full such that a new entry cannot be stored in the table, in which case the overflowing entry is stored in a CAM (Column 3, lines 23-27; column 16, lines 32-40).

Although the hash table entries of Spinney do not include flow information, the essence of his teaching is that overflowing hash table entries may be stored in a CAM. Likewise, the

essence of the limitations recited in claims 2, 17 and 48 is understood to be the storing of overflowing hash table entries in a CAM.

Spinney also teaches that the hash table in memory and the CAM are searched in parallel, thereby avoiding additional cost in time or additional circuitry (Column 16, lines 15-19 and 42-46).

Regarding claims 2, 17 and 48, it would have been obvious to one of ordinary skill in the art at the time of invention by applicant to store overflowing hash table entries (e.g. tuples and their corresponding flow information) in a CAM as taught by Spinney, in the system made obvious by the combination of APA and Lakshman, in order to solve the overflow problem created by the non-zero probability that the slots of a hash bucket will become full during network initialization or reconfiguration as taught by Spinney.

Regarding claims 12, 27 and 58, it would have been obvious to one of ordinary skill in the art at the time of invention by applicant to search the hash table in memory and the CAM in parallel as taught by Spinney, in the system made obvious by the combination of APA and Lakshman, in order to avoid additional cost in time or additional circuitry as taught by Spinney.

Regarding claims 14, 29 and 60, although the combination of APA, Lakshman and Spinney does not teach hashing on the first 96 bits of the tuple, such limitations are merely a matter of design choice. The combination APA, Lakshman and Spinney teaches the use of a

hashing function to transform an input tuple to a hashed address. The limitations in claims 14, 29 and 60 of the instant application do not define a patentably distinct invention over the combination of APA, Lakshman and Spinney since both are directed toward generating a uniform distribution of hashed addresses from the input tuples. As it is well known in the art that the uniformity of a hashing function may depend strongly on the range of inputs to the function and the frequency of these inputs, and because neither the instant application nor the combination of APA, Lakshman and Spinney provide specific details on this parameter, and the instant application provides no specific details concerning the hashing function, the number of bits used in the hashing function is inconsequential as a whole as it may be presumed that any number of choices might yield an acceptable result. Therefore, to use the first 96 bits would have been an obvious design choice to one of ordinary skill in the art at the time of invention by applicant.

Regarding claims 15, 30 and 61, although the combination of APA, Lakshman and Spinney does not teach the use of three 32-bit comparators and standard 16 or 32-bit wide memories, such limitations are merely a matter of design choice. The combination of APA, Lakshman and Spinney teaches the use of a comparison unit and memory to compare and store tuples. The limitations in claim 15, 30 and 61 of the instant application do not define a patentably distinct invention over the combination of APA, Lakshman and Spinney since both are directed toward matching incoming tuples with tuples stored in memory. The widths and groupings of the particular comparators and memories are inconsequential as long as the comparison and storage can be made on a selection of bits which are sufficient to guarantee that

a tuple does not match the wrong hash bucket or the wrong slot in a hash bucket. Therefore, to use three 32-bit comparators and standard 16 or 32-bit wide memories would have been an obvious design choice to one of ordinary skill in the art.

14. Claims 3, 18 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214) as applied to claims 1, 16 and 47 above, and further in view of Chaudri (US 6,275,861).

APA and Lakshman are relied upon for the teachings relative to claims 1, 16 and 47 above.

APA and Lakshman do not teach that the process flow information stored in the memory comprises a flow identification number as required by claims 3, 18 and 49.

Chaudri teaches a system for identifying flows in a data system where the process flow information is stored in a hash table in memory, and this information comprises a flow identifier (Column 3, lines 50-52; column 4, lines 45-47; Fig. 6; column 4, lines 39-63). Chaudri also teaches that multiple flows may be associated with a common or default flow identifier, which reduces the number of search table entries that must be maintained (Column 3, lines 58-61; column 4, lines 53-54; column 6, lines 9-13).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to store the process flow information of the system made obvious by the combination of APA and Lakshman, in the form of a flow identifier as taught by Chaudri, considering the similarity in the nature of the problems to be solved and the well-known practice in the art of using indirection where information is represented by an index or pointer, as in the flow identifier taught by Chaudri, thereby allowing the flexibility of one-to-one or many-to-one (such as for a default flow processing as taught by Chaudri) correspondence between flows and their associated processing information, as well as allowing updates to flow processing information without disturbing the stored flow indentifiers or interrupting the flow identifier search process.

15. Claims 4-5, 19-20 and 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214) as applied to claims 1, 16 and 47 above, and further in view of Kerr (US 6,590,894).

APA and Lakshman are relied upon for the teachings relative to claims 1, 16 and 47 above.

APA and Lakshman do not teach that the process flow information stored in the memory can be updated as required by claims 4, 19 and 50, nor do they teach that the process flow information stored in the memory can be deleted as required by claims 5, 20 and 51.

Kerr teaches a system for processing flows in a data system where the process flow information is stored in a flow cache (i.e. hash table) in memory (Fig. 3; column 4, lines 11-14; column 6, lines 36-53), and this information comprises routing information, access control information, special treatment information and accounting information for packets in the flow (Column 6, lines 54-67). Kerr also teaches that the accounting portion of the process flow information in the memory may be updated (Column 5, lines 13-18) and that this information may be used by interested parties to diagnose actual or potential network problems (Column 8, line 66 to column 9, line 7), and that flows which are no longer valid due to timeouts, changes to "next hop" information or changes in access control lists may be deleted (Column 3, lines 48-51; column 5, line 54 to column 6 line 31).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to update and delete process flow information as taught by Kerr, in the system made obvious by the combination of APA and Lakshman, in order to supply accounting information related to a flow to interested parties for diagnosis of network problems, and to remove information from the hash table for flows that are no longer valid due to timeouts and changes to "next hop" information or access control lists as taught by Kerr.

16. Claims 6, 21 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214) as applied to claims 1, 16 and 47 above, and further in view of Thomas (A User Guide to the Unix System, Rebecca Thomas, et al, 1985).

APA and Lakshman are relied upon for the teachings relative to claims 1, 16 and 47 above.

APA and Lakshman do not teach a kill-process command by which a search for an entry in the memory may be ceased as required by claims 6, 21 and 52.

Thomas teaches termination of a process via a kill command utilized for circumstances where an executing process does not need to be run or may not be functioning correctly (Page 151, paragraph 1).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to incorporate a kill-process command as taught by Thomas, in the system made obvious by the combination of APA and Lakshman, for the purpose of terminating an executing search for an entry in the memory in the circumstance where the search process does not need to be run or is not functioning correctly as taught by Thomas.

17. Claims 7, 22 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214), and further in view of Spinney (US 5,414,704) as applied to claims 2, 17 and 48 above, and further in view of Chaudri (US 6,275,861).

APA, Lakshman and Spinney are relied upon for the teachings relative to claims 2, 17 and 48 above.

APA, Lakshman and Spinney do not teach that the process flow information stored in the CAM comprises a flow identification number as required by claims 7, 22 and 53.

It is recognized that the CAM merely serves to store overflowing hash table entries and that otherwise its purpose in the system is identical to the hash table stored in memory, which is the storage and retrieval of tuples and process flow information for packet classification.

Therefore, claims 7, 22 and 53 are rejected under the same rationale used in the application of Chaudri for the rejection of claims 3, 18 and 52 above.

18. Claims 8-9, 23-24 and 54-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214), and further in view of Spinney (US 5,414,704) as applied to claims 2, 17 and 48 above, and further in view of Kerr (US 6,590,894).

APA, Lakshman and Spinney are relied upon for the teachings relative to claims 2, 17 and 48 above.

APA, Lakshman and Spinney do not teach that the process flow information stored in the CAM can be updated as required by claims 8, 23 and 54, nor do they teach that the process flow information stored in the CAM can be deleted as required by claims 9, 24 and 55.

It is recognized that the CAM merely serves to store overflowing hash table entries and that otherwise its purpose in the system is identical to the hash table stored in memory, which is the storage and retrieval of tuples and process flow information for packet classification.

Therefore, claims 8-9, 23-24 and 54-55 are rejected under the same rationale used in the application of Kerr for the rejection of claims 4-5, 19-20 and 50-51 above.

19. Claims 10, 25 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214), and further in view of Spinney (US 5,414,704) as applied to claims 2, 17 and 48 above, and further in view of Thomas (A User Guide to the Unix System, Rebecca Thomas, et al, 1985).

APA, Lakshman and Spinney are relied upon for the teachings relative to claims 2, 17 and 48 above.

APA, Lakshman and Spinney do not teach a kill-process command by which a search for an entry in the memory may be ceased as required by claims 10, 25 and 56.

It is recognized that the CAM merely serves to store overflowing hash table entries and that otherwise its purpose in the system is identical to the hash table stored in memory, which is the storage and retrieval of tuples and process flow information for packet classification.

Therefore, claims 10, 25 and 56 are rejected under the same rationale used in the application of Thomas for the rejection of claims 6, 21 and 52 above.

20. Claims 11, 26 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (APA) (Instant application) in view of Lakshman ("High-speed

policy-based packet forwarding using efficient multi-dimensional range matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214), and further in view of Spinney (US 5,414,704) as applied to claims 2,17 and 48 above, and further in view of Sternberger (US 4,788,656).

APA, Lakshman and Spinney are relied upon for the teachings relative to claims 2, 17 and 48 above.

APA, Lakshman and Spinney do not teach the generation of a trap (i.e. interrupt) when the search memory and CAM are full as required by claims 11, 26 and 57.

Sternberger teaches a memory (Fig. 4, elements 52 and 54), where an interrupt is generated when the memory is full, and that the interrupt is received by a host processor that takes appropriate action to avoid lost data (Column 8, lines 2-12).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to incorporate the memory-full interrupt of Sternberger in the system made obvious by the combination of APA, Lakshman and Spinney in order to allow a processor to take appropriate action to avoid lost data.

21. Claims 31-46 and 62-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman ("High-speed policy-based packet forwarding using efficient multi-dimensional range

matching", ACM SIGCOMM Computer Communication Review, vol. 28, No. 4, 1998, pp. 203-214) in view of Liao (US 6,185,208) and applicant's admitted prior art (APA).

Lakshman teaches a traditional flow-cache architecture for packet classification in which incoming headers (i.e. tuples) are analyzed and when the header identifies a new flow, the header together with an associated action that must be applied to all packets in the flow (i.e. process flow information) are inserted in a hash table (Page 204, section 2.1, paragraph 1).

Lakshman further teaches that when subsequent packets in the flow arrive, the corresponding action is determined from the hash table (Page 204, section 2.1, paragraph 1).

Lakshman still further teaches that the input tuple size is between 100 and 200 and that the hash index is no more than 20 (Page 205, column 1, lines 13-19).

Therefore as in claim 31, Lakshman is seen to teach generating an M-bit hash address from an N-bit input tuple wherein N is larger than 96 and M is equal to or smaller than 20.

Lakshman does not teach the hashing method of steps a) through c) as found in claim 31.

Lakshman also does not teach that the N-bit tuple includes information about a source address, a destination address, protocol, a source and destination port as required by claim 31.

Liao discloses a hash function operating on the combination of an IP address and port number (i.e. a tuple) in which the 4 bytes comprising the IP address and the 2 bytes of the port

number are reduced using a series of consecutive exclusive-OR operations on the bytes (Column 8, lines 9-14; equation 1). According to the associative property of the exclusive-OR operation, the expression of equation 1 can be interpreted as in claims 31 and 39 to perform a hashing function on an N-bit tuple according to the following steps:

a) splitting the tuple comprising the N bits of $IP_1$,$IP_2$,$IP_3$,$IP_4$,$P_1$ and $P_2$ into a first range comprising X bits of $IP_1$,$IP_2$,$IP_3$,$IP_4$ and $P_1$, and a second range comprising the Y bits of $P_2$;

b) applying an exclusive-OR hash function to the first range to generate an Z-bit hash address; and

c) creating an M-bit hash address by combining the results of the hash of the first range with the second range of Y-bits using a Boolean operator.

Regarding claim 31, it would have been obvious to one of ordinary skill in the art at the time of invention by applicant to apply a hashing algorithm such as that of Liao, in the method of Lakshman, due to the similar nature of the problems to be solved, namely reducing an input tuple from a first number of bits to a second, smaller number of bits in order to provide efficient lookup of tuples. It is further noted that Liao would suggest a general principle for reducing a tuple by hashing, and therefore it would have been obvious to adapt the algorithm to match the input and output sizes required by Lakshman.

APA teaches that the N-bit tuple may include information about a source address, a destination address, protocol, a source and destination port (Page 3, lines 1-3).

Further regarding claim 31, it would have been obvious to one of ordinary skill in the art at the time of invention by applicant to comprise the tuple of Lakshman according to the tuple taught by APA, due to the similarity in nature of the problems, namely to provide a unique tuple adequate for packet classification in a network.

Applying the nomenclature of the claims to the above steps of Liao, N=48, X=40, Y=8, Z=8 and M=8. Therefore it is noted that as in claim 32, Liao teaches that X is larger than Y, and as in claim 33, Liao teaches that X is larger than Z.

Regarding claims 34 and 62, it is noted that the Liao discloses that the Boolean operator is an exclusive-OR function, where it is known that such a function is inherently defined using a combination of Boolean operators comprising "AND" and "OR" functions and therefore Liao is seen to teach using an "AND" Boolean operator and an "OR" Boolean operator to create the M-bit hash address.

As in claim 35, Liao discloses that the Boolean operator is an exclusive-OR.

As in claim 36, APA teaches that the N-bit tuple is 104-bits (Page 3, lines 1-14).

As in claim 37, Liao teaches that Y is equal to 8.

As in claim 38, Lakshman teaches that M=20.

Regarding claims 37-38, although the combination of Lakshman, Liao and APA does not explicitly teach that X=96 and Z=20, such limitations are merely a matter of design choice and would have been obvious in the system of Lakshman, Liao and APA. The combination of Lakshman, Liao and APA teaches reducing a 104-bit tuple to a 20-bit hashed value using a particular set of method steps. The limitations in claims 37-38 of the instant application do not define a patentably distinct invention over Lakshman, Liao and APA since both are directed toward generating hashed addresses from input tuples using identical steps. As it is well known in the art that the effectiveness of a hashing function (e.g. producing a uniformly distributed output range) may depend strongly on the range of inputs to the function and the frequency of these inputs, and because neither the instant application nor Liao provide specific details on this parameter, and the instant application provides no specific details concerning the hashing function, the number the subdivision in step a) of these bits into two parts comprising X and Y bits, and the number of bits Z in the intermediate result of step b) are inconsequential as a whole as it may be presumed that any number of values for these parameters might yield an acceptable result.

Claims 39-46 and 63 are rejected using the same rationale as for the rejection of claims 31-38 and 62 above.

***Response to Arguments***

22. Applicant's arguments filed 7 July 2004 with respect to the rejection of claims 1-30, 32-33, 40-41 and 47-61 under the second paragraph of 35 U.S.C. 112 have been fully considered but they are not fully persuasive.

Regarding claims 1-30 and 47-61, the amendment has overcome the rejection under the second paragraph of 35 U.S.C. 112.

Regarding claims 32-33 and 40-41, the amendment has not overcome the rejection under the second paragraph of 35 U.S.C. 112 as detailed above.

23. Applicant's arguments filed 7 July 2004 with respect to the rejection of claims 31-33, 35, 39-41 and 43 under 35 U.S.C. 102(e) have been fully considered but are ~~not~~ moot in view of the new grounds of rejection under 35 U.S.C. 103(a) as detailed above.

24. Applicant's arguments filed 7 July 2004 with respect to the rejection of claims 1, 16 and 47 under 35 U.S.C. 103(a) have been fully considered but they are not persuasive.

Applicant asserts that because Lakshman teaches that hashing a 100 to 200 bit key to 20 to 24 bits is non-trivial and presents requirements for such an embodiment, Lakshman therefore does not suggest this embodiment and cannot be used to reject claims 1, 16 and 47 (Page 18, first

paragraph). It is noted that as part of this argument Applicant acknowledges that Lakshman describes this very embodiment.

Furthermore, Applicant is reminded that disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use." In re Gurley, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994).

Applicant further asserts that the present invention overcomes the significant limitation noted by Lakshman (Page 18, second paragraph). Applicant is also reminded that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Claims 1, 16 and 47 contain no subject matter to distinguish them over the combination of references cited in the rejection above.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

25. Applicant's arguments filed 7 July 2004 with respect to the rejection of claims 2-14, 17-30 and 48-61 under 35 U.S.C. 103(a) have been fully considered but they are not persuasive.

Applicant asserts that ~~because~~ Lakshman teaches away from hashing a 100 to 200 bit key to 20 to 24 bits by suggesting a different preferred solution (Page 19, second paragraph). Applicant is again reminded that disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. In re Susi, 440 F.2d 442, 169 USPQ 423 (CCPA 1971).

Applicant also argues that the Examiner has failed to show a motivation for combining the teachings of Lakshman and Spinney (Page 19, second paragraph). In response to this assertion, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

Applicant is referred to the rejection of claims 2 and 12 under 35 U.S.C. 103(a) where motivation for combining Spinney with Lakshman and APA has been given as:

***"... in order to solve the overflow problem created by the non-zero probability that the slots of a hash bucket will become full during network initialization or reconfiguration as taught by Spinney."***

and

***"... in order to avoid additional cost in time or additional circuitry as taught by Spinney."***

Finally, regarding Applicant's arguments in paragraph 3 on page 19, Applicant is reminded that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John M Ross whose telephone number is (703) 305-0706. The examiner can normally be reached on M-F 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabhan can be reached on (703) 306-2903. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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